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(to be used for all correspondence after initial filing)

Application Number 09/788,303

Filing Date 02/16/2001

First Named Inventor Sercel

Group Art Unit

Examiner Name

Total Number of Pages in This Submission 26

Attorney Docket Number ALG06NP

ENCLOSURES (check all that apply)☒ Fee Transmittal Form☒ Fee Attached☒ Amendment / Reply☐ After Final☐ Affidavits/declaration(s)☐ Extension of Time Request☐ Express Abandonment Request☐ Information Disclosure Statement☐ Certified Copy of Priority Document(s)☐ Response to Missing Parts/
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Date

04/08/2002

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FEE TRANSMITTAL for FY 2002

Patent fees are subject to annual revision.

TOTAL AMOUNT OF PAYMENT (\$) 2298.00

Complete if Known

Application Number 09/788,303
Filing Date 02/16/2001
First Named Inventor Sercel
Examiner Name
Group Art Unit
Attorney Docket No. ALG06NP

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TC 1700

METHOD OF PAYMENT

1. ☐ The Commissioner is hereby authorized to charge indicated fees and credit any overpayments to:

Deposit Account Number
Deposit Account Name

☐ Charge Any Additional Fee Required Under 37 CFR 1.16 and 1.17

☒ Applicant claims small entity status. See 37 CFR 1.27

2. ☒ Payment Enclosed:

☐ Check ☒ Credit card ☐ Money Order ☐ Other

FEE CALCULATION

1. BASIC FILING FEE

Large Entity Fee Code (\$)	Small Entity Fee Code (\$)	Fee Description	Fee Paid
101 740	201 370	Utility filing fee	
106 330	206 165	Design filing fee	
107 510	207 255	Plant filing fee	
108 740	208 370	Reissue filing fee	
114 160	214 80	Provisional filing fee	

SUBTOTAL (1) (\$)

2. EXTRA CLAIM FEES

Total Claims	Extra Claims	Fee from below	Fee Paid
252	-20** = 232	9.00	2088.00
9	-3** = 5	42.00	210.00
Multiple Dependent			

Large Entity Fee Code (\$)	Small Entity Fee Code (\$)	Fee Description
103 18	203 9	Claims in excess of 20
102 84	202 42	Independent claims in excess of 3
104 280	204 140	Multiple dependent claim, if not paid
109 84	209 42	** Reissue independent claims over original patent
110 18	210 9	** Reissue claims in excess of 20 and over original patent

SUBTOTAL (2) (\$) 2298.00

**or number previously paid, if greater; For Reissues, see above

FEE CALCULATION (continued)

3. ADDITIONAL FEES

Large Entity Fee Code (\$)	Small Entity Fee Code (\$)	Fee Description	Fee Paid
105 130	205 65	Surcharge - late filing fee or oath	
127 50	227 25	Surcharge - late provisional filing fee or cover sheet	
139 130	139 130	Non-English specification	
147 2,520	147 2,520	For filing a request for <i>ex parte</i> reexamination	
112 920*	112 920*	Requesting publication of SIR prior to Examiner action	
113 1,840*	113 1,840*	Requesting publication of SIR after Examiner action	
115 110	215 55	Extension for reply within first month	
116 400	216 200	Extension for reply within second month	
117 920	217 460	Extension for reply within third month	
118 1,440	218 720	Extension for reply within fourth month	
128 1,960	228 980	Extension for reply within fifth month	
119 320	219 160	Notice of Appeal	
120 320	220 160	Filing a brief in support of an appeal	
121 280	221 140	Request for oral hearing	
138 1,510	138 1,510	Petition to institute a public use proceeding	
140 110	240 55	Petition to revive - unavoidable	
141 1,280	241 640	Petition to revive - unintentional	
142 1,280	242 640	Utility issue fee (or reissue)	
143 460	243 230	Design issue fee	
144 620	244 310	Plant issue fee	
122 130	122 130	Petitions to the Commissioner	
123 50	123 50	Processing fee under 37 CFR 1.17(q)	
126 180	126 180	Submission of Information Disclosure Stmt	
581 40	581 40	Recording each patent assignment per property (times number of properties)	
146 740	246 370	Filing a submission after final rejection (37 CFR § 1.129(a))	
149 740	249 370	For each additional invention to be examined (37 CFR § 1.129(b))	
179 740	279 370	Request for Continued Examination (RCE)	
169 900	169 900	Request for expedited examination of a design application	

Other fee (specify)

*Reduced by Basic Filing Fee Paid

SUBTOTAL (3) (\$)

SUBMITTED BY

Name (Print/Type) David S. Alavi

Registration No. (Attorney/Agent) 40,310

Complete (if applicable)

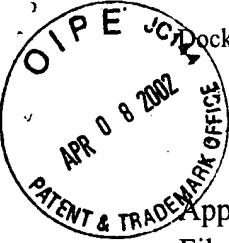
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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

#5A/BM
4-17-02

Applicants: Sercel et al

Filed: 02/16/2001

App. No.: 09/788,303

For: Cylindrical processing of optical media

PRELIMINARY AMENDMENT UNDER 37 CFR §1.115

Commissioner for Patents
Washington, DC 20231

04/08/2002

Sir:

Please amend the above named application as set forth below.

AMENDMENTRECEIVED
APR 16 2002
TC 1700

Please insert the following new claims.

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20. A method for producing a spatially selective alteration on a substantially cylindrical optical medium, the method comprising the steps of:
rotating the optical medium about a longitudinal relative rotation axis thereof relative to a processing tool; and
spatially selectively applying the processing tool to a portion of the surface of the optical medium, in operative cooperation with relative rotation of the optical medium and the processing tool thereby spatially selectively altering the optical medium to produce the spatially selective alteration thereon.
21. The method of Claim 20, wherein the optical medium comprises an optical fiber.
22. The method of Claim 21, wherein the optical fiber comprises a silica-based optical fiber.
23. The method of Claim 21, wherein the optical fiber includes a core, a cladding layer surrounding the core, and an outer fiber coating surrounding the cladding layer.
24. The method of Claim 21, wherein the optical fiber includes a hermetic carbon outer coating layer.
25. The method of Claim 21, further comprising the step of reducing a diameter of the optical fiber by pre-etching the optical fiber before applying the processing tool to the optical fiber.
26. The method of Claim 21, wherein the optical fiber comprises a single-mode optical fiber.

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2088.00 DP

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27. The method of Claim 21, wherein the optical fiber comprises a multi-mode optical fiber.
 28. The method of Claim 21, wherein the optical fiber comprises a hollow-core optical fiber.
 29. The method of Claim 21, wherein the optical fiber comprises a hollow-core optical fiber and the hollow core contains at least one of an optically scattering material and an optically absorbing material.
 30. The method of Claim 20, wherein the spatially selective alteration includes at least one ring between first and second segments of the optical fiber.
 31. The method of Claim 30, wherein the spatially selective alteration includes at least one full ring.
 32. The method of Claim 30, wherein the spatially selective alteration includes at least one partial ring.
 33. The method of Claim 20, wherein the spatially selective alteration comprises a spatially-selective surface mask.
 34. The method of Claim 33, wherein the processing-tool-applying step includes the step of spatially-selectively removing portions of an outer coating of the optical medium thereby forming the surface mask.
 35. The method of Claim 34, further comprising the step of depositing the outer coating on the optical medium before applying the processing tool to the optical medium.
 36. The method of Claim 34, wherein the outer coating of the optical medium includes a hermetic carbon coating.
 37. The method of Claim 34, wherein the outer coating of the optical medium includes a polymeric outer coating.
 38. The method of Claim 34, wherein the outer coating of the optical medium includes a metallic outer coating.
 39. The method of Claim 34, wherein:
the outer coating of the optical medium includes a resist-type outer coating; and

the surface-mask-forming step comprises the steps of spatially selectively exposing the resist-type coating to a processing beam, and developing the resist-type outer coating to remove portions of the outer coating.

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40. The method of Claim 34, wherein the processing-tool-applying step includes surface-masked beam etching.
 41. The method of Claim 34, wherein the processing-tool-applying step includes focused-beam machining.
 42. The method of Claim 34, wherein the processing-tool-applying step includes laser machining.
 43. The method of Claim 34, wherein the processing-tool-applying step includes shadow-masked beam etching.
 44. The method of Claim 34, wherein the processing-tool-applying step includes mechanical machining.
 45. The method of Claim 33, wherein the processing-tool-applying step includes the step of forming the surface mask by spatially selective deposition of mask material on portions of the optical medium.
 46. The method of Claim 45, wherein the surface-mask-forming step includes surface-masked beam deposition.
 47. The method of Claim 45, wherein the surface-mask-forming step includes focused-beam deposition.
 48. The method of Claim 45, wherein the surface-mask-forming step includes shadow-masked beam deposition.
 49. The method of Claim 45, wherein the surface-mask-forming step includes surface-masked-processing-beam-assisted deposition.
 50. The method of Claim 45, wherein the surface-mask-forming step includes focused-processing-beam-assisted deposition.
 51. The method of Claim 45, wherein the surface-mask-forming step includes shadow-masked-processing-beam-assisted deposition.

52. The method of Claim 33, further comprising the steps of:
processing the surface-masked optical medium; and
removing at least a portion of the surface mask from the optical medium.
53. The method of Claim 52, wherein at least a portion of the surface mask is left on the optical medium to serve as an optical mode suppressor.
54. The method of Claim 20, wherein the spatially selective alteration includes spatially selective deposition of material on the optical medium.
55. The method of Claim 54, wherein the deposited material spatially selectively increases a diameter of the optical medium.
56. The method of Claim 54, wherein the deposited material serves as an optical mode suppressor.
57. The method of Claim 54, wherein the processing-tool-applying step includes surface-masked beam deposition
58. The method of Claim 54, wherein the processing-tool-applying step includes focused-beam deposition.
59. The method of Claim 54, wherein the processing-tool-applying step includes shadow-masked beam deposition.
60. The method of Claim 54, wherein the processing-tool-applying step comprises surface-masked-processing-beam-assisted deposition.
61. The method of Claim 54, wherein the processing-tool-applying step comprises focused-processing-beam-assisted deposition.
62. The method of Claim 54, wherein the processing-tool-applying step comprises shadow-masked-processing-beam-assisted deposition.
63. The method of Claim 20, wherein the spatially selective alteration includes spatially selectively removal of optical material from the optical medium.
64. The method of Claim 63, wherein removal of the material from the optical medium spatially selectively reduces a diameter of the optical medium.

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65. The method of Claim 63, wherein removal of the material from the optical medium results in at least one optical scatterer, the optical scatterer serving as an optical mode suppressor.
 66. The method of Claim 63, wherein the processing-tool-applying step includes surface-masked beam etching.
 67. The method of Claim 63, wherein the processing-tool-applying step includes focused-beam machining.
 68. The method of Claim 63, wherein the processing-tool-applying step includes laser machining.
 69. The method of Claim 63, wherein the processing-tool-applying step includes shadow-masked beam etching.
 70. The method of Claim 63, wherein the processing-tool-applying step includes mechanical machining.
 71. The method of Claim 63, wherein the processing-tool-applying step includes surface-masked wet etching.
 72. The method of Claim 71, wherein:
 - the optical medium is a silica-based optical fiber including a hermetic carbon outer fiber coating;
 - a surface mask for the optical fiber includes at least a portion of the hermetic carbon outer fiber coating; and
 - surface-masked wet etching is performed with an aqueous hydrofluoric-acid-based etchant.
 73. The method of Claim 71, wherein the etchant includes between about 5% HF and about 50% HF buffered with NH_4F .
 74. The method of Claim 71, wherein the etchant includes between about 7% HF and about 8% HF buffered with between about 30% NH_4F and about 40% NH_4F .
 75. The method of Claim 20, wherein the spatially selective alteration includes spatially selective alteration of a refractive index of the optical medium.
 76. The method of Claim 75, wherein the refractive index is increased by spatially selective optical-irradiation-induced densification of the optical medium.

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77. The method of Claim 76, wherein the densification is induced by UV irradiation.
 78. The method of Claim 76, wherein the processing-tool-applying step includes surface-masked irradiation.
 79. The method of Claim 76, wherein the processing-tool-applying step includes focused-beam irradiation.
 80. The method of Claim 76, wherein the processing-tool-applying step includes laser irradiation.
 81. The method of Claim 76, wherein the processing-tool-applying step includes shadow-masked irradiation.
 82. The method of Claim 76, wherein the optical fiber is a germano-silica optical fiber.
 83. The method of Claim 82, wherein the germano-silica optical fiber is a pre-etched germano-silica-core multi-mode optical fiber.
 84. The method of Claim 82, wherein the germano-silica optical fiber is hydrogen-loaded before irradiation.
 85. The method of Claim 82, wherein the germano-silica optical fiber is boron co-doped germano-silica optical fiber.
 86. The method of Claim 75, wherein the refractive index is altered by spatially selective doping of the optical medium.
 87. The method of Claim 86, wherein the processing-tool-applying step includes surface-masked beam doping.
 88. The method of Claim 86, wherein the processing-tool-applying step includes surface-masked diffusive doping.
 89. The method of Claim 86, wherein the processing-tool-applying step includes focused-beam doping.
 90. The method of Claim 86, wherein the processing-tool-applying step includes shadow-masked beam doping.
 91. The method of Claim 75, wherein the refractive index is altered between about 1 part in 10^5 and about 1 part in 10^2 .

92. The method of Claim 75, wherein altering the refractive index of the optical medium results in at least one optical scatterer, the optical scatterer serving as an optical mode suppressor.
93. The method of Claim 20, wherein the processing-tool-applying step includes the steps of: controlling relative longitudinal motion of the optical medium and the processing tool; and controlling relative radial motion of the optical medium and the processing tool.
94. The method of Claim 93, wherein the optical medium and the processing tool are relatively rotated by a rotation assembly including a rotary bearing and a rotary actuator.
95. The method of Claim 94, wherein thrust error for the rotary bearing is less than about 5 μm .
96. The method of Claim 94, wherein thrust error for the rotary bearing is less than about 1 μm .
97. The method of Claim 94, wherein the rotary bearing includes an air-bearing spindle.
98. The method of Claim 20, wherein the longitudinal relative rotation axis is defined by a rotation guide.
99. The method of Claim 98, wherein the rotation guide limits relative radial movement of the optical medium and the processing tool during relative rotation to less than about 5 $\mu\text{m}/\text{rev}$.
100. The method of Claim 98, wherein the rotation guide includes at least one vacuum V-block.
101. The method of Claim 98, wherein the rotation guide includes at least one capillary tube.
102. The method of Claim 98, wherein the rotation guide includes at least one fiber ferrule.
103. The method of Claim 98, wherein the rotation guide includes at least one fiber chuck.
104. The method of Claim 98, wherein the rotation guide includes at least one notched guide.
105. The method of Claim 98, wherein the rotation guide includes a pair of substantially co-axial rotation guides and the processing tool is applied to the optical medium between the pair of rotation guides.
106. The method of Claim 93, wherein the optical fiber is only partially rotated thereby producing a partial ring.

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107. The method of Claim 93, wherein application of the processing tool to the optical fiber is synchronous with relative rotation of the optical fiber and the processing tool thereby producing a partial ring.
108. The method of Claim 107, wherein the processing tool comprises a processing beam, the processing beam being synchronously attenuated while the optical medium is rotated thereby producing a partial ring.
109. The method of Claim 93, further comprising the step of moving a point of applying the processing tool longitudinally along the optical medium.
110. The method of Claim 93, wherein synchronous relative longitudinal motion of the processing tool and the optical medium during relative rotation of the optical medium produces a curvilinear ring.
111. The method of Claim 20, wherein the processing-tool-applying step includes spatially selectively applying a mechanical processing tool to the optical medium.
112. The method of Claim 20, wherein the processing-tool-applying step includes spatially selectively delivering a processing beam to the optical medium.
113. The method of Claim 112, wherein the optical medium is surface-masked.
114. The method of Claim 112, wherein the processing beam is focused.
115. The method of Claim 112, wherein the processing beam is shadow-masked.
116. The method of Claim 112, wherein the processing beam includes an optical beam.
117. The method of Claim 116, wherein the optical beam includes a laser beam.
118. The method of Claim 117, wherein the laser beam is a continuous-wave laser beam.
119. The method of Claim 116, wherein the optical beam is spatially-selectively applied to the optical medium using an optical assembly.
120. The method of Claim 119, wherein the optical assembly includes a high-NA focusing element.
121. The method of Claim 119, wherein the optical assembly includes a microscope objective.
122. The method of Claim 112, wherein the processing beam includes an ion beam.

123. The method of Claim 122, wherein the ion beam is spatially-selectively applied to the optical medium using an ion optics assembly.
124. The method of Claim 112, wherein the processing beam includes an electron beam.
125. The method of Claim 124, wherein the electron beam is spatially-selectively applied to the optical medium using an electron optics assembly.
126. The method of Claim 112, wherein the processing beam includes an x-ray beam.
127. The method of Claim 126, wherein the x-ray beam is spatially-selectively applied to the optical medium using an x-ray optics assembly.
128. The method of Claim 112, wherein the processing beam includes a neutral beam, the neutral beam including at least one of a molecular beam, an atomic beam, and a radical beam.
129. The method of Claim 128, wherein the neutral beam is spatially-selectively applied to the optical medium using a focused neutral beam source.
130. An apparatus for producing a spatially selective alteration on a substantially cylindrical optical medium, the apparatus comprising:
a processing tool;
an optical medium rotator, the rotator being adapted for rotating the optical medium about a longitudinal relative rotation axis thereof relative to the processing tool; and
a processing tool positioner, the positioner being adapted for spatially selectively applying the processing tool to a portion of the surface of the optical medium in operative cooperation with relative rotation of the optical medium and the processing tool thereby altering the optical medium to produce the spatially selective alteration thereon.
131. The apparatus of Claim 130, wherein the optical medium rotator includes a rotary bearing and a rotary actuator.
132. The apparatus of Claim 131, wherein thrust error for the rotary bearing is less than about 5 μm .
133. The apparatus of Claim 131, wherein thrust error for the rotary bearing is less than about 1 μm .
134. The apparatus of Claim 131, wherein the rotary bearing includes an air-bearing spindle.

135. The apparatus of Claim 130, further comprising an optical-medium rotation guide defining the longitudinal relative rotation axis.
136. The apparatus of Claim 135, wherein the rotation guide limits relative radial movement of the optical medium and the processing tool during relative rotation to less than about 5 $\mu\text{m}/\text{rev}$.
137. The apparatus of Claim 135, wherein the rotation guide includes at least one vacuum V-block.
138. The apparatus of Claim 135, wherein the rotation guide includes at least one capillary tube.
139. The apparatus of Claim 135, wherein the rotation guide includes at least one fiber ferrule.
140. The apparatus of Claim 135, wherein the rotation guide includes at least one fiber chuck.
141. The apparatus of Claim 135, wherein the rotation guide includes at least one notched guide.
142. The method of Claim 135, wherein the rotation guide includes a pair of substantially co-axial rotation guides and the processing tool is positioned so as to be applied to the optical medium between the pair of rotation guides.
143. The apparatus of Claim 130, further comprising a processing tool controller, the processing tool controller being adapted for coupling application of the processing tool to the optical medium and relative rotation of the optical medium and the processing tool.
144. The apparatus of Claim 143, wherein the processing tool controller is adapted for only partially rotating the optical medium thereby producing a partial ring.
145. The apparatus of Claim 143, wherein the processing tool controller is adapted for synchronously applying the processing tool while the rotating the optical medium thereby producing a partial ring.
146. The apparatus of Claim 145, wherein the processing tool comprises a processing beam, and the processing tool controller includes an attenuator for synchronously attenuating the processing beam while the optical medium is rotated thereby producing a partial ring.
147. The apparatus of Claim 130, wherein the processing tool positioner includes a longitudinal actuator adapted for moving a point of applying the processing tool longitudinally along the optical medium.

148. The apparatus of Claim 147, wherein the longitudinal actuator and the optical medium rotator are adapted for providing synchronous relative longitudinal motion of the processing tool and the optical medium during relative rotation of the optical medium thereby producing a curvilinear ring.
149. The apparatus of Claim 130, wherein the processing tool comprises a mechanical processing tool.
150. The apparatus of Claim 130, wherein the processing tool includes a processing beam source and a processing beam delivery assembly for spatially selectively delivering the processing beam to the optical medium.
151. The apparatus of Claim 150, wherein the processing beam delivery assembly is adapted for focusing the processing beam.
152. The apparatus of Claim 150, further comprising a shadow-mask adapted for spatially-selectively applying the processing beam to the optical fiber.
153. The apparatus of Claim 150, wherein the processing beam is an optical beam and the processing beam source includes an optical beam source.
154. The apparatus of Claim 153, wherein the optical beam is a laser beam and the processing beam source includes a laser source.
155. The apparatus of Claim 154, wherein the laser source is a continuous-wave laser source.
156. The apparatus of Claim 153, wherein the beam delivery assembly includes an optical assembly.
157. The apparatus of Claim 156, wherein the optical assembly includes a high-NA focusing element.
158. The apparatus of Claim 156, wherein the optical assembly includes a microscope objective.
159. The apparatus of Claim 150, wherein the processing beam is an ion beam and the processing beam source includes an ion beam source.
160. The apparatus of Claim 159, wherein the beam delivery assembly includes an ion optics assembly.

161. The apparatus of Claim 150, wherein the processing beam is an electron beam and the processing beam source includes an electron beam source.
162. The apparatus of Claim 161, wherein the beam delivery assembly includes an electron optics assembly.
163. The apparatus of Claim 150, wherein the processing beam is an x-ray beam and the processing beam source is an x-ray beam source.
164. The apparatus of Claim 163, wherein the beam delivery assembly includes an x-ray optics assembly.
165. The apparatus of Claim 150, wherein the processing beam is a neutral beam, the neutral beam comprising at least one of a molecular beam, an atomic beam, and a radical beam, and the processing beam source includes a neutral beam source.
166. The apparatus of Claim 165, wherein the beam delivery assembly comprises a focused neutral beam source.
167. A method for fabricating at least one fiber-ring resonator on a resonator optical fiber, the fiber-ring resonator comprising a transverse fiber-ring resonator segment integral with the resonator optical fiber between first and second segments of the resonator optical fiber, the resonator segment having a circumferential optical path length sufficiently different from a circumferential optical path length of an immediately adjacent portion of at least one of the first and second segments of the resonator optical fiber so as to enable the resonator segment to support at least one resonant optical mode near an outer circumferential surface of the resonator segment, the method comprising the steps of:
rotating the resonator optical fiber about a longitudinal relative rotation axis thereof relative to a processing tool; and
spatially selectively applying the processing tool to at least a portion of a surface of the resonator optical fiber thereby producing a difference between the circumferential optical path length of the resonator segment and the circumferential optical path length of the immediately adjacent portion of at least one of the first and second segments of the resonator optical fiber.
168. The method of Claim 167, wherein the resonator segment is greater than about 1 μm in width.

169. The method of Claim 167, wherein the resonator segment is greater than about 2 μm in width.
170. The method of Claim 167, wherein the resonator segment is less than about 10 μm in width.
171. The method of Claim 167, wherein the resonator segment is less than about 4 μm in width.
172. The method of Claim 167, wherein the resonator segment is greater than about 10 μm in diameter.
173. The method of Claim 167, wherein the resonator segment is greater than about 20 μm in diameter.
174. The method of Claim 167, wherein the resonator segment is greater than about 100 μm in diameter.
175. The method of Claim 167, wherein the resonator segment is greater than about 400 μm in diameter.
176. The method of Claim 167, wherein the resonator segment is greater than about 500 μm in diameter.
177. The method of Claim 167, wherein the resonator segment is less than about 150 μm in diameter.
178. The method of Claim 167, wherein the resonator segment is less than about 200 μm in diameter.
179. The method of Claim 167, wherein the resonator segment is less than about 600 μm in diameter.
180. The method of Claim 167, wherein the resonator segment is less than about 1000 μm in diameter.
181. The method of Claim 167, wherein a spectral width of a resonance band of the fiber-ring optical resonator is smaller than an optical channel spacing of the optical WDM system.

182. The method of Claim 167, wherein comprising wherein a spectral width of a resonance band of the fiber-ring optical resonator is substantially equal to an optical channel spacing of the optical WDM system.
183. The method of Claim 167, wherein a spacing between spectrally-adjacent resonance bands of the fiber-ring optical resonator is greater than an optical channel spacing of the optical WDM system.
184. The method of Claim 167, wherein spectrally-adjacent resonance bands of the fiber-ring optical resonator are spaced by about an integer times an optical channel spacing of the optical WDM system.
185. The method of Claim 184, wherein the optical WDM system is an optical DWDM system having a channel spacing less than about 400 GHz.
186. The method of Claim 184, wherein spectrally-adjacent resonance bands of the fiber-ring optical resonator are spaced by about twice the optical channel spacing of the optical WDM system.
187. The method of Claim 167, wherein applying the processing tool to the resonator optical fiber includes removing material from the immediately adjacent portions at least one of the first and second segments of the resonator optical fiber so that a radius of the resonator segment is sufficiently larger than a radius of the immediately adjacent portion of at least one of the first and second segments of the resonator fiber so as to enable the resonator segment to support at least one resonant optical mode near an outer circumferential surface of the resonator segment.
188. The method of Claim 187, wherein the resonator segment of the resonator fiber is at least about 0.1 μm larger in radius than the immediately adjacent portion of at least one of the first and second segments of the resonator fiber.
189. The method of Claim 187, wherein the resonator segment of the resonator fiber is at least about 0.5 μm larger in radius than the immediately adjacent portion of at least one of the first and second segments of the resonator fiber.
190. The method of Claim 187, wherein the resonator segment of the resonator fiber is at most about 20 μm larger in radius than the immediately adjacent portion of at least one of the first and second segments of the resonator fiber.

191. The method of Claim 187, wherein the resonator segment of the resonator fiber is at most about 1.5 μm larger in radius than the immediately adjacent portion of at least one of the first and second segments of the resonator fiber.
192. The method of Claim 187, wherein material is removed from the resonator optical fiber by surface-masked wet etching of the resonator optical fiber.
193. The method of Claim 192, further comprising the step of producing a surface mask on the resonator optical fiber, the surface mask including a primary masked ring substantially covering the resonator segment between unmasked rings on the first and second segments of the resonator optical fiber.
194. The method of Claim 193, wherein the unmasked rings are produced by laser machining of a resonator optical fiber outer coating layer.
195. The method of Claim 193, wherein the surface mask includes a secondary masked ring adjacent the primary masked ring with a secondary unmasked ring therebetween, the primary masked ring being wider than the secondary masked ring, the secondary masked ring being wider than the secondary unmasked ring, so that upon etching of the resonator fiber an axially-displaced fiber-taper positioning-and-support structure is produced on the resonator optical fiber adjacent the fiber-ring resonator, the positioning-and-support structure including a radially-extending radially-tapered transverse flange.
196. The method of Claim 195, wherein the positioning-and-support structure extends completely around the resonator optical fiber.
197. The method of Claim 195, wherein the positioning-and-support structure subtends an angle less than about 180° .
198. The method of Claim 195, wherein the positioning-and-support structure subtends an angle greater than about 45° .
199. The method of Claim 195, wherein the positioning-and-support structure is greater than about 10 μm in length.
200. The method of Claim 195, wherein the positioning-and-support structure is greater than about 50 μm in length.

201. The method of Claim 195, wherein the positioning-and-support structure is less than about 500 μm in length.
202. The method of Claim 195, wherein the positioning-and-support structure is less than about 150 μm in length.
203. The method of Claim 192, wherein:
- the resonator fiber is a silica-based optical fiber;
 - the surface mask comprises portions of a hermetic carbon outer coating layer of the resonator optical fiber; and
 - the etching employs an aqueous-hydro-fluoric-acid-based etchant.
204. The method of Claim 192, further comprising the step of removing at least a portion of the surface mask from the resonator optical fiber after etching.
205. The method of Claim 192, further comprising the step of leaving at least a portion of the surface mask remaining on at least one of the first and second segments of the resonator optical fiber after etching, the remaining portion of the surface mask serving as an optical mode suppressor.
206. The method of Claim 192, further comprising the step of a second surface-masked wet etch, wherein a second surface mask includes an unmasked ring on the resonator segment between masked rings on the resonator segment, so that upon etching of the resonator fiber a radially-displaced fiber-taper positioning-and-support structure is produced on a circumference of the fiber-ring resonator, the positioning-and-support structure including paired axially-juxtaposed radially-extending radially-tapered transverse flanges.
207. The method of Claim 167, further comprising the step of adjusting an optical resonance frequency of the fiber-ring resonator after fabricating the fiber-ring resonator on the resonator optical fiber.
208. The method of Claim 207, wherein the adjusting step includes irradiating the fiber-ring resonator with ultra-violet light thereby altering the resonance frequency by altering a refractive index of the fiber-ring resonator.
209. The method of Claim 207, wherein the adjusting step includes doping the fiber-ring resonator thereby altering the resonance frequency by altering a refractive index of the fiber-ring resonator.

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210. The method of Claim 207, wherein the adjusting step includes etching the fiber-ring resonator thereby altering the resonance frequency by altering a diameter of the fiber-ring resonator.
211. The method of Claim 207, wherein the adjusting step includes depositing optical material on the fiber-ring resonator thereby altering the resonance frequency by altering a diameter of the fiber-ring resonator.
212. The method of Claim 167, further comprising the step of providing a radially-extending transverse flange on at least one of the first and second segments of the resonator optical fiber, the flange being adapted for engaging a corresponding groove in an alignment housing.
213. The method of Claim 167, further comprising the step of providing a circumferential groove on at least one of the first and second segments of the resonator optical fiber, the groove being adapted for engaging a corresponding flange in an alignment housing.
214. A method for fabricating multiple fiber-ring resonators on a resonator optical fiber, the fiber-ring resonators each comprising a transverse fiber-ring resonator segment integral with the resonator optical fiber and separated from each adjacent resonator fiber segment by an intervening fiber segment, the multiple fiber-ring resonators being positioned between first and second segments of the resonator optical fiber, the resonator segments each having a circumferential optical path length sufficiently different from a circumferential optical path length of at least one adjacent intervening segment of the resonator optical fiber so as to enable the multiple resonator segments to support at least one resonant optical mode of a resulting coupled-optical-resonator system near an outer circumferential surface of the resonator segments, the method comprising the steps of:
rotating the resonator optical fiber about a longitudinal relative rotation axis thereof relative to a processing tool; and
spatially selectively applying the processing tool to at least a portion of a surface of the resonator optical fiber thereby producing a difference between the circumferential optical path length of the resonator segments and the circumferential optical path length of the intervening segments of the resonator optical fiber.

215. The method of Claim 214, wherein applying the processing tool includes removing material from intervening segments of the resonator optical fiber so that the radii of the resonator segments are sufficiently larger than the radii of the intervening segments of the resonator fiber so as to enable the multiple resonator segments to support at least one resonant optical mode of a resulting coupled-optical-resonator system near an outer circumferential surface of the resonator segments.
216. The method of Claim 215, wherein material is removed from the resonator optical fiber by surface masked wet etching of the resonator optical fiber.
217. The method of Claim 216, further comprising the step of producing a surface mask on the resonator optical fiber, the surface mask including multiple masked rings substantially covering the multiple resonator segments between multiple unmasked rings on the intervening segments of the resonator optical fiber.
218. The method of Claim 214, wherein the multiple fiber-ring resonators include at least four fiber-ring resonators.
219. The method of Claim 214, wherein a spectral width of a resonance band of the coupled-optical-resonator system is smaller than an optical channel spacing of the optical WDM system.
220. The method of Claim 214, wherein comprising wherein a spectral width of a resonance band of the coupled-optical-resonator system is substantially equal to an optical channel spacing of the optical WDM system.
221. The method of Claim 214, wherein a spacing between spectrally-adjacent resonance bands of the coupled-optical-resonator system is greater than an optical channel spacing of the optical WDM system.
222. The method of Claim 214, wherein spectrally-adjacent resonance bands of the coupled-optical-resonator system are spaced by about an integer times an optical channel spacing of the optical WDM system.
223. The method of Claim 222, wherein the optical WDM system is an optical DWDM system having a channel spacing less than about 400 GHz.

224. The method of Claim 222, wherein spectrally-adjacent resonance bands of the coupled-optical-resonator system are spaced by about twice the optical channel spacing of the optical WDM system.

225. The method of Claim 214, wherein:

each of the multiple fiber-ring resonators has substantially the same width, substantially the same diameter, and substantially the same de-coupled resonance frequency; and each intervening segment has substantially the same width and substantially the same diameter.

226. The method of Claim 225, wherein the intervening segments are greater than about 1 μm in width.

227. The method of Claim 225, wherein the intervening segments are less than about 20 μm in width.

228. The method of Claim 225, wherein:

the intervening segments are between about 5 μm and about 15 μm in width; and the intervening segments are less than about 0.7 μm smaller in radius than the resonator segments.

229. The method of Claim 225, wherein:

the intervening segments are between about 1 μm and about 5 μm in width; and the intervening segments are greater than about 1 μm smaller in radius than the resonator segments.

230. A method for fabricating a fiber-taper alignment-and-support structure on a fiber-taper support fiber, the fiber-taper alignment-and-support structure comprising a taper-support segment integral with the fiber-taper support fiber between first and second segments of the fiber-taper support fiber, the taper-support segment being adapted for substantially reproducibly and substantially stably positioning a fiber-taper engaged therewith, the method comprising the steps of:
rotating the taper-support optical fiber about a longitudinal relative rotation axis thereof relative to a processing tool; and

spatially selectively applying the processing tool to at least a portion of a surface of the taper-support optical fiber thereby producing the fiber-taper alignment-and-support structure on the taper-support segment of the taper-support optical fiber.

231. The method of Claim 230, wherein the positioning-and-support structure extends completely around the taper-support optical fiber.

232. The method of Claim 230, wherein the positioning-and-support structure subtends an angle less than about 180°.

233. The method of Claim 230, wherein the positioning-and-support structure subtends an angle greater than about 45°.

234. The method of Claim 230, wherein the positioning-and-support structure is greater than about 10 μm in length.

235. The method of Claim 230, wherein the positioning-and-support structure is greater than about 50 μm in length.

236. The method of Claim 230, wherein the positioning-and-support structure is less than about 500 μm in length.

237. The method of Claim 230, wherein the positioning-and-support structure is less than about 150 μm in length.

238. The method of Claim 230, wherein applying the processing tool to the taper-support optical fiber includes removing material from the immediately adjacent portions at least one of the first and second segments of the taper-support optical fiber so that a radially-extending transverse flange results.

239. The method of Claim 238, wherein material is removed from the taper-support optical fiber by surface-masked wet etching of the taper-support optical fiber.

240. The method of Claim 239, further comprising the step of producing a surface mask on the taper-support optical fiber, the surface mask including a primary masked ring on the taper-support segment between unmasked rings on the first and second segments of the taper-support optical fiber.

241. The method of Claim 240, wherein the unmasked rings are produced by laser machining of a taper-support optical fiber outer coating layer.

242. The method of Claim 240, wherein the surface mask further includes an unmasked ring on the taper-support segment between masked rings on the taper-support segment, so that upon etching of the taper-support fiber a fiber-taper positioning-and-support structure is produced on the taper-support fiber, the positioning-and-support structure including paired axially-juxtaposed radially-extending radially-tapered transverse flanges.

243. The method of Claim 239, wherein:

the taper-support fiber is a silica-based optical fiber;

the surface mask comprises portions of a hermetic carbon outer coating layer of the taper-support optical fiber; and

the etching employs an aqueous-hydro-fluoric-acid-based etchant.

244. The method of Claim 239, further comprising the step of removing at least a portion of the surface mask from the taper-support optical fiber after etching.

245. The method of Claim 239, further comprising the step of leaving at least a portion of the surface mask remaining on at least one of the first and second segments of the taper-support optical fiber after etching, the remaining portion of the surface mask serving as an optical mode suppressor.

246. The method of Claim 230, wherein applying the processing tool to the taper-support optical fiber includes removing material from the taper-support segment of the taper-support optical fiber so that a circumferential groove results.

247. The method of Claim 246, wherein material is removed from the taper-support optical fiber by surface-masked wet etching of the taper-support optical fiber.

248. The method of Claim 247, further comprising the step of producing a surface mask on the taper-support optical fiber, the surface mask including a primary unmasked ring on the taper-support segment between masked rings on the first and second segments of the taper-support optical fiber.

249. The method of Claim 247, wherein:

the taper-support fiber is a silica-based optical fiber;

the surface mask comprises portions of a hermetic carbon outer coating layer of the taper-support optical fiber; and

the etching employs an aqueous-hydro-fluoric-acid-based etchant.

250. The method of Claim 247, further comprising the step of leaving at least a portion of the surface mask remaining on at least one of the first and second segments of the taper-support optical fiber after etching, the remaining portion of the surface mask serving as an optical mode suppressor.

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251. The method of Claim 230, further comprising the step of providing a radially-extending transverse flange on the taper-support optical fiber, the flange being adapted for engaging a corresponding groove in an alignment housing.

252. The method of Claim 230, further comprising the step of providing a circumferential groove on the taper-support optical fiber, the groove being adapted for engaging a corresponding flange in an alignment housing.
